

X-38 Begins Flight Testing

By Karen Schmidt

For the first time in 20 years, JSC engineers rolled out a prototype of a new space craft that could be the predecessor for the next century's regular mode of human transportation into space.

The JSC Advanced Development Office reached a turning point this month when the first X-38 test vehicle left Bldg. 220 enroute to Dryden Flight Research Center for its first series of flight tests. With the shipment of vehicle 131 to the California coast, the combined JSC/Dryden team will be able to collect valuable aerodynamic data.

"Beginning full-scale flight tests is a big milestone for us that the team has been looking forward to with a lot of excitement," said X-38 Project Manager John Muratore. "No one has ever done anything like this—deploying a parafoil from a lifting body and flying a lifting body with an all electric flight control system—before, and there are unknowns. We expect surprises. But we have done a lot of work to minimize the unknowns and we are confident this vehicle can perform well."

Vehicle 131 will begin tests in July at Dryden with "captive carry" flights, during which the vehicle will remain attached to a NASA B-52 aircraft—the same B-52 that carried the X-15 research aircraft in the 1960s.

"The captive carry tests will verify the vehicle's flutter and structural loads margins for the flight test envelope, as well as allow us to

evaluate the operation of 131's systems in the flight environment and verify our software and procedures for the free-flight tests," said John Hooper, X-38 Deputy Project Manager for Systems Engineering.

In early September, 131 will begin a series of drop tests, with release points at altitudes of 25,000 to 50,000 feet. After a short free-flight period, the vehicle will deploy the parafoil and glide to the landing site. Hooper said the parafoil itself was a challenge to design and build.

The early parafoil development was performed by NASA's Marshall Space Flight Center in a program that started in the late 1980s, followed by a U.S. Army program in the early 1990s. Hooper said early X-38 project parafoil flights experienced a series of problems with the parafoil, and after consulting the sport parachute industry and experts from labs across the country, the JSC team established a series of design modifications to improve the parafoil's deployment, inflation and flight characteristics.

"The parafoil testing has been performed at the Army's Yuma Proving Ground in Arizona," Hooper said. "The Yuma testing began with drop tests of the parafoil on an Army air drop pallet, and have progressed to testing with an X-38 skeletal model, we call the 'doghouse.'"

The "doghouse" tests allow the parafoil to be deployed in a manner that simulates the vehicle 131 deployment sequence.

"Vehicle 131 does not have an active flight control system so its

rudder and body flaps are in fixed positions," Hooper said. "This will restrict the vehicle's free flight time but will allow us to verify the parafoil deployment sequence from the vehicle and to evaluate the transition from lifting body flight to parafoil flight."

Simulations of flight operations also were conducted to prepare the team for the Dryden tests. Team members participated in classroom training, aircraft flights and mission simulations to give personnel in the B-52 a feel for actual flight tests. As a group the team conducted more than 22 flight simulations for each of the positions on the flight team.

"The X-38 project was started with a small team doing feasibility studies in late 1994," Hooper said. "The project got a 'go' in the spring of 1995, expanded the team and moved into Bldg. 361. The contract for the fabrication of the 131 airframe was awarded to Scaled Composites in February 1996 and the vehicle was delivered in September 1996."

At JSC, the vehicle went through

structural testing and system installation and checkout from September 1996 through May 1997.

Following the tests of 131 this summer, a second vehicle with an active flight control system—vehicle 132—will be tested at Dryden in the late 1997, early 1998 time frame, Hooper said. The 132 airframe, also constructed by Scaled Composites, was received at JSC in December and is currently undergoing wiring and subsystem installation in Bldg. 220.

"The active flight control will allow longer free flight times compared to 131," Hooper said. "Design and fabrication of the first space-flight capable vehicle, vehicle 201, also has begun with assembly to take place at JSC in Bldg. 220. The 201 vehicle will be carried into earth orbit by the shuttle for a space flight test in the 2000 time frame."

Once testing is complete, designs and lessons learned will be the foundation for an International Space Station "lifeboat," and the first new human space craft to travel into

space in more than 20 years.

"With the data and lessons learned we gather from these flight tests, we can prepare vehicle 201 for space flight and from there provide space station crew members with a reliable emergency vehicle in space," Hooper said.

The goal of the Advanced Development Office is to develop the vehicle taking advantage of already available equipment and technology for as much as 80 percent of the design.

"Using available technology and off-the-shelf equipment can significantly reduce cost," Muratore said. "The original estimates to build a capsule-type crew return vehicle several years ago amounted to more than \$2 billion in total development cost. The X-38 team will build and test two prototype spacecraft for \$90 million, and we believe we can provide four operational crew return vehicles that are more capable and versatile than earlier designs, for less than a quarter of the original estimates." □

